FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 68 Thursday, September 3, 1942 No. 1359

The Cleveland Convention Papers—III

The foundry technicians of the world have given much attention to eradicating defects in castings arising from "hot-spots" consequent upon the design causing sharp necks of sand to protrude into the mould cavity. Few have considered how this phenomenon could be put to good use, and it is pleasing to read in a Paper on "Atmospheric Pressure and the Steel Casting—A New Technique in Gating and Risering," by Mr. Howard F. Taylor and Mr. Edward A. Rominski, how this has been done. Relative to the shrink-bob type of blind riser, the authors detail successful experiments they have made by inserting into the shrink-bob cavity a length of core terminating in the position where they wish the metal to remain liquid for feeding the castings. This Paper is from the Naval Research Laboratory, and two other Papers from associated sources—the Norfolk Navy Yard—also deal with steel castings. A very long one by Mr. S. W. Brinson and Mr. J. A. Duma details a study on centre line shrinkage. A suggested remedy is the application of padding, and so thorough has been the research that it has been possible for the authors to state exactly the amount necessary to add. The second Paper is "Making Navy Steel in Basic Electric Furnaces," by Mr. S. W. Brinson and Mr. F. B. Anderson. The authors admit that the Paper is unorthodox, and we read how a 6-ton Greaves-Etchells furnace was so overloaded that a number of 19-ton alloy heats were made. With the aid of a second furnace of this type of 3-tons capacity, six castings each requiring 28 tons of metal were poured. Thus 11 tons must have been melted in the smaller unit. Surely these are records in overloading! Plants more recently installed have been subjected to similar treatment. Other unorthodox features are a life of but 50 heats from a firebrick roof, and using a mixture of aluminium turnings and lime to produce a white slag, also final killing with calcium carbide. The main feature, however, is that excellent steel castings are being made. Into this section enters the British Exchange Paper from Mr. C. H. Kain and Mr. L. W. Sanders, which has already been printed in our columns. A Paper of only limited application in this country because it deals with acid electric-furnace slag control was presented by Mr. John Juppenlatz. The published mechanical properties do not appear to be quite as good as basic steel. A useful test, taking only 3 min. to carry out, for ascertaining the susceptibility of 18:8 stainless steel castings to intergranular corrosion, is described in a Paper by Mr. H. W. Russell, Mr. H. A. Pray and Mr. Paul D. Miller. The apparatus consists of a small lead cell which is clamped against the material to be tested, and which contains a 60 per cent. sulphuric acid solution containing 5 ml. per litre of Glycyrrhiza extract. The scar revealed shows up a roughness at the grain boundaries. The contributions to the steel castings industry are completed by a Paper from Mr. R. H. Stone, who deals with stoppers and nozzles.

There was only one purely non-ferrous Paper presented, and that was a Committee Report on "Tin Bronzes." It covers the whole range from fundamental metallurgy to fields of use, including detail as to the desirable properties to be shown by the moulding sands used.

There is much matter of fundamental importance in a Paper by Mr. J. T. Eash which deals with the "Effects of Ladle Inoculation in Austenitic Cast Iron." The author has used the "Ni-Resist" composition for his experiments, and has used silicon ranging from 0.0 to 1.2 per cent as the inoculant. A feature of the Paper is the inclusion of Izod values. Krynitsky and Saeger have made a further valuable contribution to the study of cast

(*Continued overleaf.*)

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THE CLEVELAND CONVENTION PAFERS—III

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irons by evaluating its elastic properties in relation to superheating, pouring temperatures and microstructure. Though Mr. Robert R. Adams has produced a very large quantity of data for his Paper on "Cast-Iron Strength *versus* Structure," he has not drawn any quantitative conclusions, but has contented himself by illustrating the general relationships by means of a series of charts. Generally speaking, tensile strength can be correlated with structure, but not so clear is the relationship between transverse strength and structure or Brinell hardness and structure.

Mr. M. N. Dastur and Mr. M. Cohen have collaborated in a Paper on the "Effect of Phosphorus on the Growth of Cast Iron." Unfortunately from the English point of view, the authors have taken 1.0 per cent. phosphorus as their upper limit, whereas added interest would have been given if 1.8 per cent. had been chosen. Their main finding is that phosphorus improves growth resistance from the three angles surveyed. A Paper reminiscent of Mr. R. C. Tucker's to the 1940 meeting of the Institute of British Foundrymen has been presented by Mr. C. O. Burgess and Mr. A. E. Schrubsall. It carries the title of "Machinable 1.5 per cent. and 2.0 per cent. Chromium Cast Irons to Resist Deterioration at High Temperatures." As a comparison Paper there is one on "A Metallurgical Study of Cast Iron for Glass-Forming Moulds," by Mr. W. H. Bruckner and Harry Czyzewski, but the main topic of this contribution is the development of an accelerated surface crazing or "heat cheeks" conditions, and then applying these to a range of cast irons. The choice of compositions seems somewhat strange to those having a knowledge of current British practice. Though the number of Papers on cast iron is much fewer than is usual, the high quality has been well maintained.

United States Steel Output.—Production of steel ingots and castings in the United States during the first six months of 1942 established a new peak of 42,570,247 net tons, more than 4 per cent. above the 40,908,543 tons produced in the corresponding period of the record-breaking year 1941, according to the American Iron and Steel Institute. Output in the first half of 1940 was 30,404,653 tons. Open-hearth steel production in the 1942 half-year amounted to 37,889,027 tons, or 2 per cent. above the first half of last year, and Bessemer steel production of 2,798,956 tons was 8 per cent. higher. Production of electric furnace steel in the first six months of 1942 totalled 1,882,364 tons, or nearly 50 per cent. higher than in the corresponding period of 1941.

MANUFACTURE OF STEELWORKS PLANT

NEW DIRECTORS OF DAVY & UNITED ENGINEERING

As recently announced, the board of Davy & United Engineering Company, Limited, has been increased by three: Mr. A. C. Macdiarmid, Sir Walter Benton Jones, Bt., and Mr. John E. James having agreed to serve as directors of the company. Mr. Macdiarmid is chairman of Stewarts and Lloyds, Limited, Sir Walter Benton Jones is chairman of the United Steel Companies, Limited, and Mr. James is chairman of the Lancashire Steel Corporation, Limited

Referring to these appointments at the annual meeting of Davy & United Engineering Company, Limited, held in Sheffield last week, Mr. E. J. Fox (chairman) said that the new directors were placing their knowledge and experience at the disposal of the company with a view to establishing a closer technical collaboration between user and manufacturer. This collaboration would ensure a progressive policy of technical development in the joint interests of the engineering industry and of the steel industry. There was no question of the steel companies obtaining a dominating financial interest in Davy & United Engineering, and neither was there any intention of forming a combination in the nature of a "ring."

The long-term policy of the board was to create a modern efficient undertaking, capable of providing service to the iron and steel industry better, they hoped, than, and certainly not inferior to, that available from outside the country, and to this end the co-operation with the actual users of their products would prove of the greatest advantage. They had cause at too many of their meetings in the past to complain of unfair and, as they foresaw, highly dangerous competition from abroad. This state of affairs affected not only their home trade, but the highly important export business, and in the long run would have proved embarrassing to users of foreign-made equipment. Such a position was not only a danger to British industry, but, what was more important, it was a greater danger to national security, and he was sure it was in the national interest, no less than that of industry, that co-operation between user and manufacturer should be encouraged so that strong and efficient groups could emerge which were a strength in times of difficulty and in normal times.

It was with this end in view—the ultimate creation of an engineering unit capable of giving adequate and efficient service on terms and conditions advantageous to the consumer—that they had enlisted the assistance of the three new directors.

CANADIAN PRODUCTION of steel ingots and steel castings during May totalled 272,247 net tons, compared with 264,988 tons made in April last and with 230,843 tons made in May, 1941. Production of pig-iron during May totalled 171,386 net tons, as against 160,408 tons made in April last and 127,259 tons in May, 1941.

THE FOUNDRY INDUSTRY AND AIR WARFARE — III

A LIGHT-ALLOY FOUNDRY OF ROLLS-ROYCE LTD.

A description of practice at an important light-alloy foundry making Merlin XX Aircraft Engines

The foundry building of this particular works covers an area of approximately three acres, and finds employment for over 2,000 people, working two shifts. The conditions for the workpeople are, in the opinion of our representative, the best that could possibly be desired. Canteens are provided as part of the foundry building, and facilities for the entertainment of the workeople during the meal breaks by the well-known E.N.S.A. concert parties and other local professional and amateur performers, are available. The lighting, which is of the highest order, consists of a balanced system of standard and mercury vapour lighting, which is particularly effective. Heating is by means of unit heaters at intervals in the roof of the foundry. The ventilating system deals with 130,000 cub. ft. of air per min. from the building, and renders the atmosphere fresh and clear during the whole of the working day. The building is wired throughout with loudspeaker units over which are relayed "Music while you work" programmes at various set intervals during the day. Other activities of the welfare section include the provision of a mutual aid fund to cover foundry workers during absence from work owing to illness, subscriptions for which are deducted weekly from their wages.

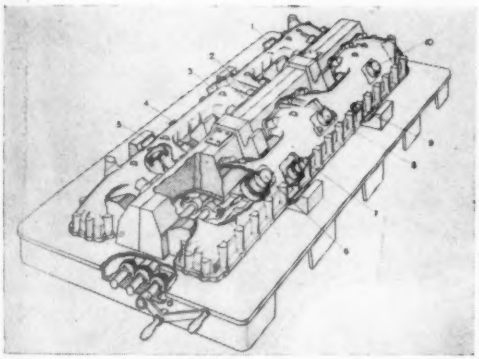


FIG. 1.—SKETCH OF MERLIN XX INDUCTION MANIFOLD PATTERN IN PART SECTION.

Patternshop and Foundry Tool Room

The manufacture and maintenance of the pattern equipment, gravity and pressure dies, jigs, fixtures and gauges for a mechanised foundry is essentially of the utmost importance, so that when Rolls-Royce, Limited, planned the largest mechanised light alloy foundry in the country for the manufacture of castings for the Merlin engine, very special attention was justifiably paid to the patternshop and foundry tool room to ensure that above all the equipment installed left nothing to be desired from the point of view of general utility relative to the problem to be tackled, and secondly that the skilled labour employed in these sections should have the opportunity of a specialised training on aero-engine work with the best and latest equipment available.

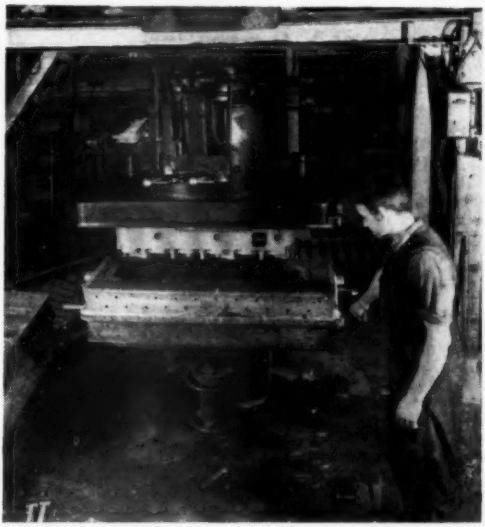


FIG. 2.—MERLIN XX CYLINDER BLOCK MOULDING MACHINE.

In the early stages of development of the foundry, therefore, local patternmakers were drafted to Coventry, always regarded as the home of the internal combustion engine industry, for a training period on wood and metal patternmaking alongside experts, these trained men then forming the nucleus around which the present department was built up. When it

A Rolls-Royce Light-Alloy Foundry

is realised that the foundry under review employs only 30 per cent. of skilled labour on production and that more than 50 per cent. of the unskilled labour is female, it will be appreciated that the ingenuity of the pattern-maker is often taxed to the limit to provide patterns and coreboxes requiring the minimum of skill to manipulate. A typical example of this is shown in the sketch of a pattern plate (Fig. 1) for the induction manifold—moulding two castings at one operation and incorporating a mechanism for withdrawing simultaneously ten inclined bosses into the pattern, thereby eliminating the necessity for outside "cover cores" and producing a cleaner and more accurate casting with less risk of scrap due to misplaced cores. The same principle is illustrated in Fig. 2, where four bosses on the cylinder block pattern have been withdrawn from the mould.

FIG. 3.—MERLIN XX UPPER HALF CRANKCASE MOULDING MACHINE.

Pattern and Corebox Materials

Various materials are used in connection with the manufacture of the pattern and dies according to the particular service required for the part. For example, the pattern shown in Fig. 3 for the upper half crankcase is a "composite" build-up of hard-wood and light alloy, with certain of the hard-wearing inserts in steel. The majority of the remaining patterns are made as light-alloy castings with steel or phosphor bronze inserts "cast" in position wherever possible on the wearing surfaces.

Cast iron is frequently resorted to for coreboxes where the weight factor for female coremakers permits or can be overcome by mechanical means, particularly in those cases such as the exhaust port cores on the cylinder block which have to be reproduced 12 times per engine. These cast-iron coreboxes stand up to the production of 80,000 to 100,000 cores before any appreciable wear is found to have taken place. Other materials seen to be in common use, in most cases in intermediary stages, were plaster of paris, stone, a lead-tin alloy, and dental wax.

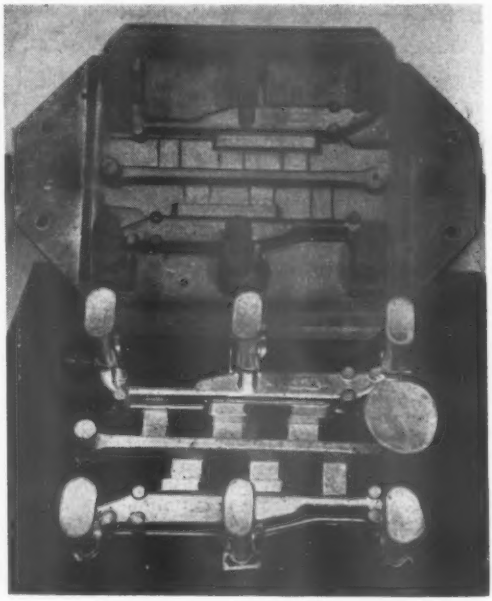


FIG. 4.—PATTERN PLATE FOR GATING SYSTEM INCORPORATED AND SAMPLE CASTING OF CONTROL BRACKET.

A Rolls-Royce Light-Alloy Foundry

Gating and Venting Systems Standardised

All gating systems used in the foundry are incorporated on the pattern equipment, a typical example of which is shown in Fig. 4, thereby eliminating these variables which must inevitably creep in were the moulders allowed to "cut" their own gating systems in the mould. Fig. 5 shows a typical gallery venting system used in the inlet port core for the cylinder block, the steel rod which forms the gallery vent from end to end of the core giving location to the vent rods inserted into each leg of the exhaust port. After each of these rods has been inserted and withdrawn in the rammed core, the gallery rods are turned through 90 deg., and the vent hole formed in the portions between the gallery rod and the outer face of the core is then filled in. By this means, an excellent artificial vent into each leg of the core with only one outlet from the core itself is formed. This policy of incorporating the details of foundry technique in the pattern equipment is considered to be of prime importance in the maintenance of satisfactory results in the foundry, and doubtless contributes largely to the remarkably low production "cycle" times which have been achieved.

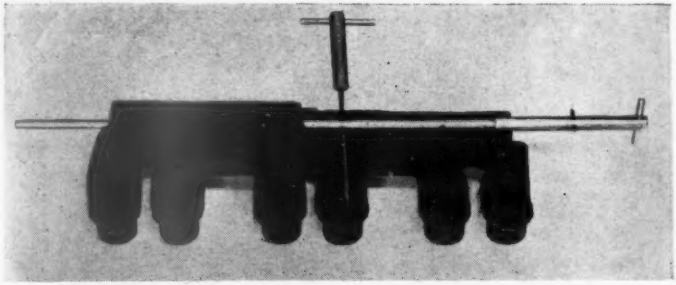


FIG. 5.—GALLERY VENTING SYSTEM ON CYLINDER BLOCK INLET PORT CORE.

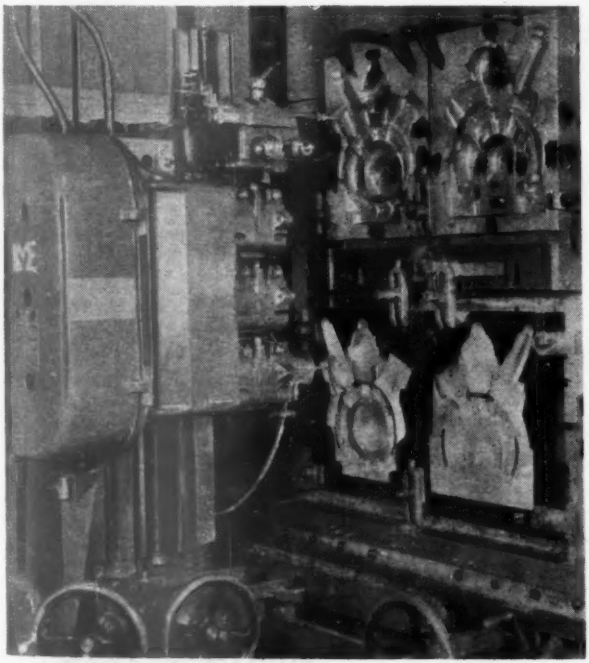


FIG. 6.—KELLER MACHINE WITH TYPICAL COMPLICATED DIE.

Reproduction from Master Patterns

Obviously quantity production foundry methods frequently call for more than one set of patterns to be in work at one time. On the cylinder block, for example, there are always at least four patterns in production, each of which incorporates the use of 48 separate sand cores. It will be appreciated, therefore, that in the early planning of the patternshop, it was obvious that provision must be made for the accurate duplication of production pattern equipment, which must essentially be interchangeable to minimise foundry production hold-up due to maintenance work on any individual item. This accurate duplication to extremely fine limits of equipment is facilitated by the use of a Pratt & Whitney fully automatic 3-spindle Keller duplicator and Gorton milling machine with duplication table.

The Keller duplicator, when reproducing a supercharger casing pattern in aluminium alloy from the original wood pattern, required approximately 150 hrs., which represents a very considerable saving of time over the best alternative method.

The duplicating of an induction manifold pattern on the Gorton milling machine equipped with a duplicating table, though not fully automatic and therefore calling for a certain skill on the part of the operator, introduces a material advantage in speeding up the accurate duplication of patterns.

Two further typical examples of duplication of pattern equipment being carried

A Rolls-Royce Foundry

out on the Keller duplicator are shown in Figs. 6 and 7. Fig. 6 shows the duplication of a breather corebox for the Merlin XX upper half crankcase, whilst Fig. 7 shows the reproduction of two lower half crankcase metal patterns simultaneously from an already proved master pattern. Obviously, these accurately reproduced patterns can be released for production to the foundry with the minimum of delay for "proofing," since the model from which they are reproduced to very fine limits has already passed the necessary proof inspection.

Figs. 8 and 9 are particularly interesting examples of the adaptation of the Keller duplicator to the foundry problem, the parts being reproduced in this case are the top and bottom die blocks, after completion, in work in Fig. 10. In the case of Fig. 8 the model is hardwood block shaped accurately to the desired shape of the top core for the die. After reproducing this top core on the cast-iron die block, a plaster of paris cast is taken from the model of the top block and this plaster case is used in turn as the model in Fig. 9. The cutter used on the cast-iron die block in Fig. 9 is, of course, larger than the tracer head by the desired metal thickness of the casting to be produced from the finished die.

The fact that patternmakers' contraction, or shrinkage, allowances on patterns vary according to the size, design, material and casting temperature of the ultimate casting is well known. For example, certain engine castings in the alloy used are worked to 1/96 contraction, whilst others in the same alloy are made to 1/77 contraction. Then again, certain of the aluminium and silicon bronzes require pattern contraction allowances of as high as 1/48. This variation of contraction allowances on patterns normally debars from the patternmaker the use of fine measuring instruments,

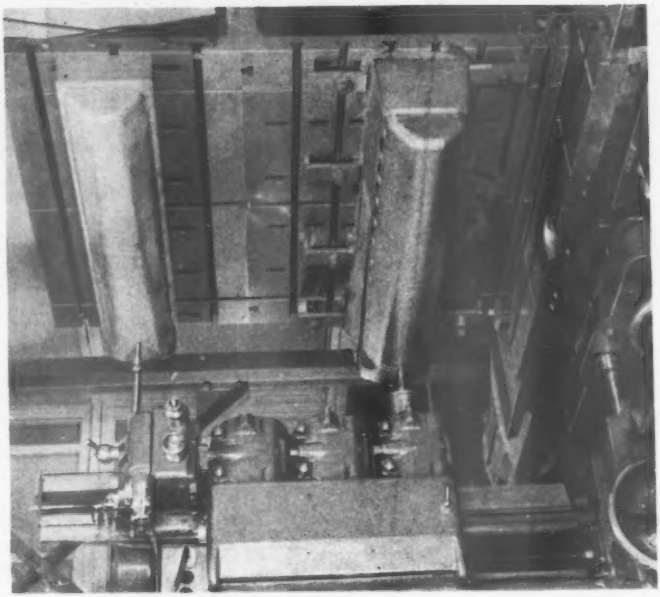


FIG. 8.—KELLER MACHINE WITH MERLIN XX ROCKER COVER CORE.

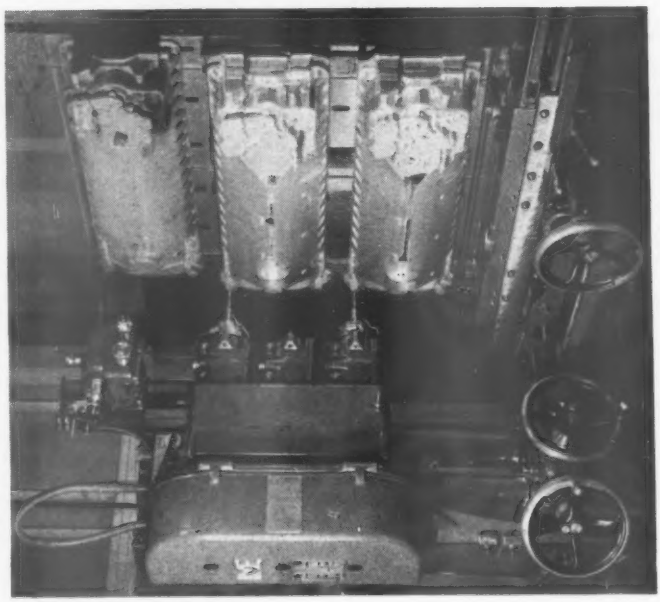


FIG. 7.—KELLER MACHINE WITH MERLIN XX CRANKCASE PATTERN.

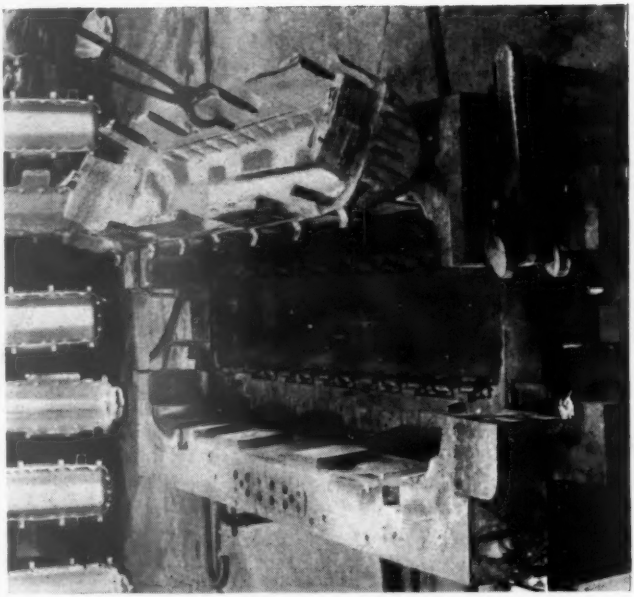


FIG. 10.—MERLIN XX ROCKER COVER DIE.

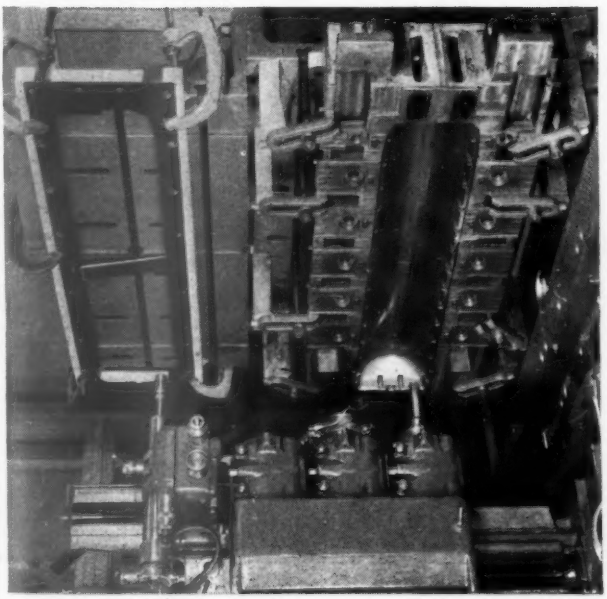


FIG. 9.—KELLER MACHINE WITH MERLIN XX ROCKER COVER DIE.

A Rolls-Royce Foundry

such as the Vernier height gauge, micrometer, etc. This difficulty has been overcome in the department under review, all dimensions being issued from the foundry drawing office to include the contraction allowances, so that the pattern-maker has the full advantage of the fine measuring instruments of the engineering world. Fig. 11 is a general view of the patternshop and foundry tool room engaged on the manufacture and maintenance of tools and equipment for the foundry.

Chills and Core Carriers

The whole of the chills required in the foundry are produced and fitted to master models in the patternshop before release — large quantities of these are required and a system of identification has been instituted to render their ready return to the starting point easy. Fig. 12 shows a typical arrangement of chills, mainly produced in cast iron for the face of the wheelcase casting. Each chill carries a series of code letters indicating clearly to the sorter whether the chill is required for a core or mould, the engine part on which used and the position on the pattern or corebox.

Core carriers are also produced in the patternshop in large quantities. These are, undoubtedly, an important contributory factor to the successful use of female unskilled and semi-skilled coremakers in the foundry. Each core carrier is an accurate replica of the actual corebox and enables the female coremaker to produce the most intricate shaped cores without the danger of scrap due to distortion during the drying operations. Fig. 13 shows a group of cores in position in cast-iron core carriers, from which it will be clearly appreciated that core distortion in drying by the use of these shaped carriers is entirely eliminated. Each core carrier is jig drilled and fitted to fine limits of accuracy to match up with the master corebox, and provided the iron castings are suitably designed and heat-treated, will continue in production for an indefinitely long period.

(*Further illustrations overleaf.*)

A Rolls-Royce Light-Alloy Foundry

Further instalments will deal with the foundry control laboratory and inspection operations, and other aspects of foundry technique and organisation.

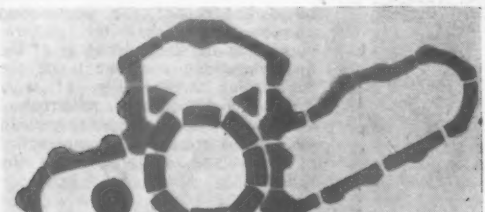


FIG. 13.—TYPICAL GROUP OF MERLIN XX CORES IN CAST-IRON CARRIERS.

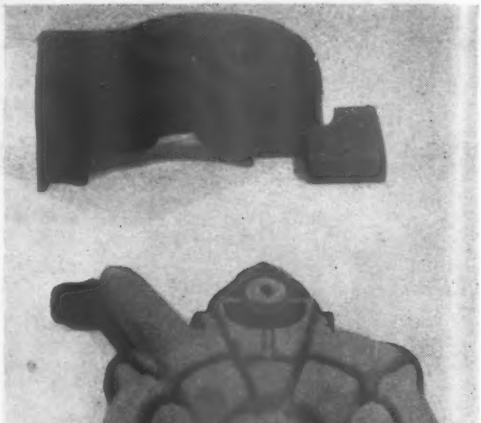
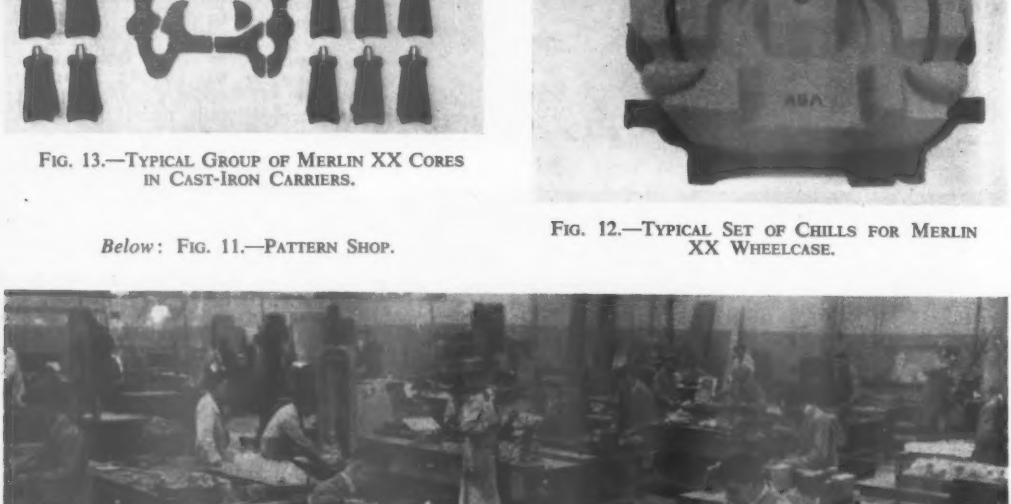


FIG. 12.—TYPICAL SET OF CHILLS FOR MERLIN XX WHEELCASE.

Below: FIG. 11.—PATTERN SHOP.



THE CASE FOR THE BABY BESSEMER

IRONFOUNDRY CONVERSION POSSIBILITIES

The utilisation of an untapped source of experienced labour by allowing wider use of steel produced by the cupola-converter method for the production of steel castings was suggested recently by Mr. C. E Sims and Mr. F. B. Dahle, research metallurgists of Battelle Memorial Institute, at a meeting of American Society for Testing Materials.

A rapid expansion of side-blow converter steel production to meet the unprecedented demand for steel castings can be achieved by the cupola-converter combination. This method, a modification of the Bessemer process, has the further advantage that many of the cupolas are already available.

The average annual production of grey-iron foundries is 10,000,000 tons of finished castings. Numerous foundries have been forced to discontinue manufacture of plumbing goods, cylinder blocks, stoves, and their other normal products. This makes available not only cupolas, but plants for conversion, fully equipped with sand-handling and moulding facilities and crews of moulders. Although not experienced in steel casting, they can learn the proper technique faster than trainees.

Cast steel is being used for aeroplane landing gears, gun mounts, tanks and other ordnance material. Much welding and riveting is eliminated, and less metal is required. Cast steel armour plate has stood up well under ballistic tests. Early Bessemer steel was relatively impure and unrefined and therefore inferior in some engineering qualities. By the use of the modern cupola with the converter, cast steel can be made to the same chemical composition as acid open-hearth or acid-electric cast steel. The data presented before the A.S.T.M. meeting prove that properly-made converter steel has engineering qualities on a par with other steels.

The electric furnace was introduced to the foundries of the United States in 1909 at a time when crucible steel was relatively expensive and the converter was almost the only producing medium open to the small jobbing foundry. The converter reached peak production in 1918 with 180,000 tons, but by 1919 the electric furnace had passed it. By 1930 the converter had fallen to a production of 16,500 tons.

Some converter shops have remained in continuous operation, and these have experienced no trouble in meeting ordinary commercial specifications. In England, a land of relatively small foundries, the converter was reported in 1936 to be still the most widely used unit for steel making in the foundry.

Early converter steel was conceded to be impure, with high contents of phosphorus and nitrogen. Today soda-ash treatment of molten cast iron for sulphur removal is developed to such a state that sulphur specifications can be readily met with converter steel. High phosphorus content can be brought within bounds by a ladle treatment with a basic, oxidising slag. Such treatments have been only recently developed, but are proving successful in operation.

Control of the metal composition charged to the converter and control of operation, such as provided by the photo-electric cell, keep the nitrogen content to a minimum. Of the various steels studied by the Battelle metallurgists, the basic open-hearth steels had the lowest phosphorus contents. Without proper identification, it would be difficult to decide from their properties by what process the others were made. The data presented showed that the room-temperature mechanical properties of all the types of steel tested were entirely orthodox for grade B cast steel and varied with the composition and type of inclusions, without regard to the method of manufacture.

Low-temperature impact properties were found to be dependent upon deoxidation practice without relation to process of manufacture. Where low-temperature toughness is required, as for example in mobile equipment used in cold climates, Mr. Sims suggested that the steel be subjected to performance tests and judged on its merits, not on method of manufacture. The Sims-Dahle report was based on a research investigation conducted in the Battelle laboratories.

X-RAY DIFFRACTION DATA

The method of identifying substances by means of their X-ray diffraction patterns is being increasingly used, and at the recent X-ray Conference of the Institute of Physics, held in Cambridge, striking examples of the applications of this technique to industrial problems were cited dealing with refractories, ferrous and non-ferrous metals, organic and inorganic chemicals. Identification of an X-ray pattern is facilitated by having for comparison purposes standard patterns of a large number of substances, and the request was made at the Conference that an attempt should be made to compile an index giving in a suitable form the diffraction data for as many substances as possible.

The American Society for Testing Materials has prepared a card index of diffraction data for about 1,300 substances, in a form suitable for use in chemical analysis by the method. The actual cards are reproduced by a photographic process from originals partly printed and partly written by hand. They give the spacings in Angströms of the three strongest lines and their approximate intensity ratios, the name and formula of the substance, and details of the powder pattern. Other relevant data are given, when known. To identify an unknown substance, a powder photograph is taken, and the spacings of the three strongest lines measured. The name of the substance is then found by locating the appropriate index card.

It is proposed by the Institute of Physics either to obtain a number of these indexes for use in this country and to supplement them with cards covering 300-500 other substances for which information is available, or to prepare a British index on similar lines. The cost of the American index is $50.00. The cost of the supplement will be kept as small as possible, but will depend on the number which are wanted. Further information may be obtained from Dr. A. J. C. Wilson, F.Inst.P., Crystallographic Laboratory, Free School Lane, Cambridge.

F

CREEP OF MALLEABLE IRON

In view of the apparent lack of creep information on malleable irons, a series of high-temperature studies on cupola malleable cast iron is particularly interesting, as reported by J. J. Kanter and Glen Guarnieri, of the Crane Company, to the annual meeting of the American Society for Testing Materials.

These studies indicated that:—

(1) At 426 deg. C., cupola malleable iron has about two-thirds of the creep strength of silicon-killed carbon steel at that temperature. Above 426 deg. C. and up to 537 deg. C. the ratio between malleable iron and steel varies between one-half and one-third.

(2) Were an allowable working stress for cupola malleable iron to be based upon these data, using a similar policy to that followed by A.S.M.E. Boiler Code, a stress of 2.5 tons per sq. in. is indicated up to 412 deg. C. This stress value is two to four times as great as used in present designs of pipe fittings, limited by codes to 232 deg. C. maximum service temperature.

(3) Prolonged fracture tests at high temperature indicate that the ductility of cupola malleable iron is unimpaired. Actually greater ductility to fracture is observed in the 482 to 650 deg. C. range than for tests at room temperature, indicating excellent time-to-fracture strength.

(4) Tension tests upon specimens with creep test history at temperatures up to 537 deg. C. show that good physical properties are retained. The only significant structural change noted micrographically is a tendency to complete graphitisation of residual pearlite.

(5) Data from accelerated tension tests, Charpy keyhole notch-bar impact tests, and endurance limit determinations for cupola malleable iron of the composition used for creep studies give a background for interpretation.

(6) No growth occurs up to 426 deg. C. at stresses of the magnitude of interest for design purposes. At 482 deg. C. and above, a slight growth appears, attributable in part to graphitisation of residual pearlite.

(7) The high temperature studies of cupola malleable iron indicate that the current engineering temperature limits upon the use of this material may be too conservative.—"Iron Age" Report.

EQUILIBRIUM DIAGRAMS BY X-RAY METHODS

A discussion on the determination of equilibrium diagrams by X-ray methods, organised by the Institution of Physics, will be held on September 22, 1942, in the Lecture Theatre of the Royal Institution (by kind permission of the Managers), 21, Albemarle Street, London, W.1. The X-ray method for investigating equilibrium diagrams has been used mainly by people who are not primarily metallurgists, but crystallographers; it is not surprising, therefore, that they have sometimes failed to adopt accepted metallurgical precautions in their experimental work. On the other hand, metallurgists have sometimes tended to consider X-rays as merely another tool for use in their work without appreciating that the information that X-rays give is fundamentally different from that given by all other methods. It is obvious that much is to be gained by a frank interchange of views between crystallographers and metallurgists. The present discussion is being arranged with this object in view.

The discussion is open to all interested. Brief introductory Papers will be read by Sir Lawrence Bragg, F.Inst.P., F.R.S. (President), Dr. A. J. Bradley, F.R.S., Dr. W. Hume-Rothery, F.R.S., Dr. M. L. V. Gayler and Prof. E. A. Owen, F.Inst.P., in the morning, and will be followed by an open informal discussion in the afternoon. The Institute of Metals will later publish a synopsis of the whole discussion in its "Journal."

Communications and inquiries regarding the discussion should be addressed to Dr. H. Lipson, F.Inst.P., Crystallographic Laboratory, Free School Lane, Cambridge.

PHOSPHOR BRONZE AND LEADED PHOSPHOR BRONZE CASTINGS

NEW B.S. SPECIFICATIONS

New war emergency British Standards Specifications Nos. 1058-1061, provide for two qualities of phosphor bronze, and have been drawn up by the British Standards Institution at the request of the Directorate of Economy of the Ministry of Supply for economy in the tin used for various alloys. B.S. 1059 relates to phosphor bronze castings corresponding to the material covered by B.S. Aircraft Specification 2B8. The latter material should now be restricted to aircraft purposes and other applications where its special properties are essential.

B.S. 1061, Leaded Phosphor Bronze Castings, covers a material of lower tin content containing both lead and zinc. Phosphor bronzes in the past have been supplied for general engineering and maintenance work as sand castings or chill cast stick using an alloy of high tin content such as is covered by B.S. 1059. For many of these applications, such high tin alloys are unnecessary, and wherever possible materials conforming to B.S. 1061 should be used and prepared as far as possible from scrap. When virgin metals have to be employed their use should be confined to B.S. 1059. B.S. 1058 and B.S. 1060 deal with ingots corresponding to the castings' Specifications.

The four Specifications are obtainable in one booklet price 2s., post paid 2s. 3d., from British Standards Institution, 28, Victoria Street, London, S.W.1.

The Institute of British Foundrymen, through its representation on British Standards Institution Committees, has assisted in the preparation of the above Specifications. The Non-Ferrous Sub-Committee of the Institute's Technical Committee are pleased to give all assistance to those engaged on the production of these alloys. Inquiries should be addressed to St. John Street Chambers, Deansgate, Manchester, 3.

ARMASTEEL—ITS MANUFACTURE, CONTROL AND APPLICATIONS

A.F.A. Exchange Paper read at June Annual Conference of The Institute of British Foundrymen

By CARL F. JOSEPH

(*Concluded from page* 397.)

Inspection Control

The foundry industry has learned a great deal from the steel forging industry, both in the practical as well as the technical side of the business. The production of ArmaSteel requires much closer control and inspection than ordinarily given in the foundry industry, but due to the nature of the parts which this material is replacing, all available tests to satisfy the manufacturers that the part is sound and free from defects are made. Castings are dissected, polished and coarse etched in a hot acid bath to bring out any unsound areas, cracks, slag, or any other hidden defects. This is a daily routine on many castings. Fig. 30 shows this set-up. Magnaflux operations are performed on certain castings, which, due to their design, are prone to crack. Fig. 31 shows this operation on ArmaSteel motor vehicle pistons. Electric resistance testing for cracks is conducted on all camshafts. Fig. 32 shows this operation on ArmaSteel motor car camshafts.

Liquid pressure testing at 1,500 lbs. per sq. in. on lorry and railway Diesel pistons is carried out on every casting to guarantee soundness and absence of leakers. Many ArmaSteel parts are completely Brinelled, where the hardness limits are a controlling factor in the successful operation of the part.

Fig. 33 shows a set-up whereby every motor car rocker arm made is ground, Brinelled and inspected. These tests illustrate the extent to which inspection control is carried out to insure satisfactory performance.

Viewpoint of Graphitic Steel

The foundryman producing graphitic steel castings must take a long range view of his possibilities of continuing to produce this metal. A few years ago such promotion usually meant competition with ferrous and non-ferrous castings, forgings, weld fabricated structures, etc. To-day producers of those materials have plenty to do to get out production and less time to look into competitive markets.

FIG. 30.—CUT-OFF MACHINE AND COARSE ETCHING ACID BATH FOR ARMASTEEL.

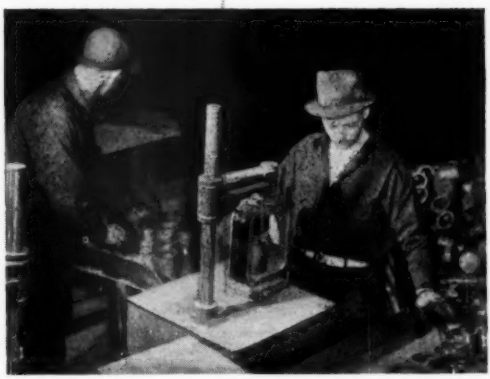


FIG. 31.—MAGNAFLUX TESTING ON AUTOMOTIVE ARMASTEEL PISTONS.

Piston Replacement

Prior to the curtailment and, finally, stoppage of motor-car production, ArmaSteel replaced aluminium for piston material. Aluminium alloys machine more readily, have better heat conductivity and have less weight of moving parts. These

ArmaSteel—Its Manufacture, etc.

offset the undesirable expansion characteristics of the metal, which are compensated for by design, and the higher cost of the metal per lb. To-day it appears that pistons will have to be made from some other material, and of all materials available, graphitic steel, without a doubt, offers the best replacement. At present motor-car and Diesel engines are successfully operating with pistons made from this material.

In an emergency many prejudices and preferences must be thrown overboard. Let it be assumed for the moment that the present emergency may bring about considerably more widespread use of

CHART NO. 2.

1.—Name of Oven ..... Location of Oven ..... Superintendent .....
2.—Composition of Coals:
Name .....
Source .....
Moisture .....
Fixed Carbon ....
Volatile Matter ....
Ash ....
Sulphur ....
3.—Ash Analysis:
SiO_2 ....
Fe_2O_3 ....
Al_2O_3 ....
Ca O ....
Mg O ....
Fusion Test ....
4.—Composition of Coal Mix:
Per cent. ....
5.—Coal Sizing: ..... per cent. through ¼-in. sieve ..... per cent. through ¼-in. ..... per cent. through ½-in.
6.—Time coal exposed to weather .....
7.—Coke Ovens:
1. Number running on our coke .....
2. Size of ovens ..... in. wide ..... ft. high ..... ft. long .....
3. Weight of coal per oven ..... tons dry
4. Weight of coke obtained per oven ..... tons dry.
8.—Coking Temperature ..... deg. F.
9.—Time at Coking Temperature ..... hrs.
10.—Are coke ovens running primarily for the making of coke or gas .....
11.—Is control of operation stressed .....
12.—Is the management progressive and open-minded .....
13.—Combustion Tests:
1. Aver. rise in temperature .....
2. Aver. time for 250 deg. temp. rise in ..... min.
3. Ignition temp. .....
14.—Coke Analysis:
Fixed carbon .....
Vol. Comb. matter .....
Ash .....
Sulphur .....
15.—Shatter Test: ..... per cent. on 2 in. sq. screen.
16.—Structure of Coke:
1. Cross fractured
2. Soft
3. Cell structure.
17.—Physical Properties:
1. Apparent Specific Gravity
2. True Specific Gravity
3. Porosity
4. Carburizing Action

graphitic steel as a replacement. It would be short-sightedness, indeed, to accept such changes as an Act of Providence and let it go at that. Unless foundrymen are alert to the possibilities, more ultimate harm than good may come from such replacements. Many applications have been brought to the attention of the foundryman, not because the manufacturer was willing to use another material, but because he found it necessary to do so in order to continue in operation. The old proverb, "Necessity is the mother of invention," has been found to hold true in the expanding use of ArmaSteel.

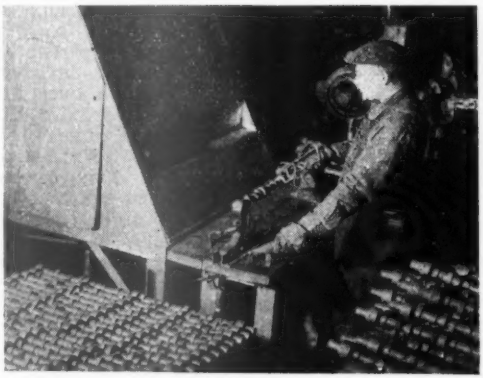


FIG. 32.—ELECTRIC RESISTANCE TESTING OF AUTOMOTIVE ARMASTEEL CAMSHAFTS.

The gauge of any return to such parts as aluminium alloy pistons will be its engineering performance as against graphitic steel, availability of the metal and its ultimate cost. The current enormous expansion of the aluminium industry suggests that before long there will be so much aluminium available that it may go begging, and at a price per unit of volume that will give present replacements some close competition. The past year has seen a 25 per cent. reduction in the market price of ingot aluminium, and further reductions without a doubt are a possibility. This means that it will be necessary for the malleable foundryman to be just one jump ahead of his competitor and continue to produce a superior product which will keep him in the lead at all times.

Desirable Properties

ArmaSteel has many desirable properties which makes it outstanding in the ferrous field. In general, the *machinability* is from 10 to 30 per cent. better than steel forgings at the same Brinell hardness. The excellent *damping* characteristics are exhibited in the many parts, such as the camshaft. It has a *high yield ratio*, especially when a Brinell hardness of 200 or over is desired. Many installations have eliminated the bronze bushing, and the excellent *non-seizing properties* in metal to metal wear are recognised. This is illustrated in the elimination of the bronze bushing in the automotive rocker arm, operating on a hardened shaft. Crankshaft tests have proved the *high fatigue life*

FIG. 33.—BRINELL TESTING OF ARMASTEEL ROCKER ARMS.

of ArmaSteel. One of its most valuable properties is that the metal responds readily to *localised* hardening, and a camshaft flame-hardening machine is shown in Fig. 34. This property is used in flame hardening and induction hardening of the cams on camshafts, shifter yokes and gears; also, the dipping of rocker arm pads in molten lead, followed by quenching. This surface hardness produces maximum wear resistance. High hardenability rating is a valuable property when this material is used to produce important gear parts. It has been found comparable to 5040-A steel, using the Jominy hardenability test-bar. Fig. 35 shows comparison of hardness cooling rate curves of ArmaSteel and forging steels, and Fig. 36 shows typical physical properties of ArmaSteel.

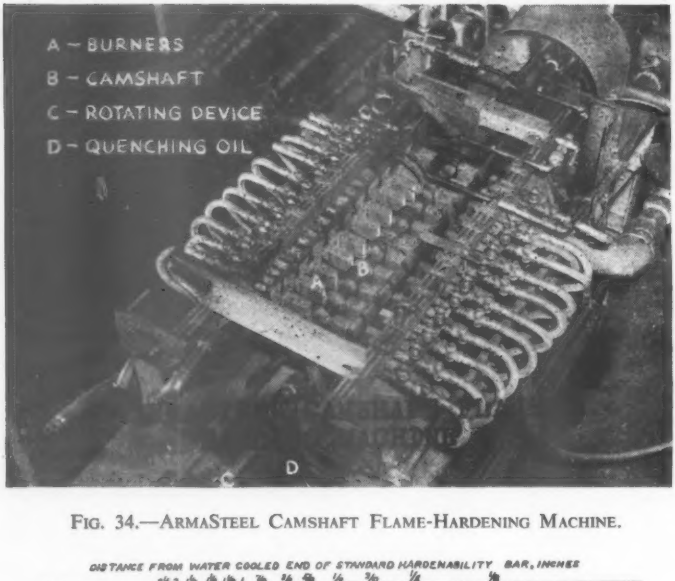


FIG. 34.—ARMASTEEL CAMSHAFT FLAME-HARDENING MACHINE.

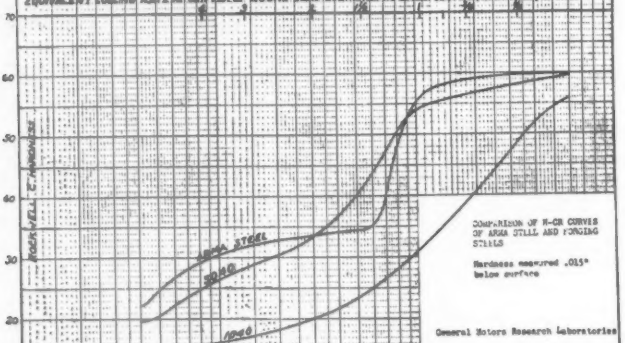

DISTANCE FROM WATER COOLED END OF STANDARD HARDENABILITY BAR, INCHES
EQUIVALENT COOLING RATE AT CENTER OF ROUND BAR QUENCHED IN STILL OIL, BAR SIZE, INCHES
EQUIVALENT COOLING RATE AT CENTER OF ROUND BAR QUENCHED IN STILL WATER, BAR SIZE, INCHES
ROCKWELL C HARDNESS
ARMA STEEL
3240
1040
COMPARISON OF H-CR CURVES OF ARMA STEEL AND FORGING STEELS
Hardness measured .015" below surface
General Motors Research Laboratories
COOLING RATE, DEG. F PER SECOND AT 1300°F.

FIG. 35.—COMPARISON OF HARDNESS/COOLING-RATE CURVES OF ARMASTEEL AND FORGING STEELS, WITH HARDNESS MEASURED 0.015 IN. BELOW SURFACE.

Hardness/Cooling-Rate Curves

Hardness-cooling rate curves show how the hardenability of ArmaSteel compares with other commonly used steels. By means of these curves, it is possible to predict what hardness can be obtained by heat-treatment of different sized sections. Knowledge of hardenability of different steels has made it possible to select the best steel for each part of the motor-car to permit obtaining the desired physical properties. This means of control has been a great aid in the more efficient use of metal, thereby increasing the performance of the car.

As the size of the part to be heat-treated increases, the speed at which it can be quenched decreases. As the speed of the quenching decreases, more alloy is required in the steel to obtain full hardening. Plain carbon steel will harden satisfactorily in light sections, but varying amounts of alloy in the steel are necessary for heavier sections, depending upon the size.

ArmaSteel has a hardenability similar to low alloy steels, and is suitable for full hardening up to $\frac{3}{4}$ in. dia. when oil quenched, or $1\frac{1}{2}$ in. dia. when water-quenched.

Machinability

One of the greatest advantages in favour of castings is the possibility of placing metal exactly where it will do the most good. This eliminates considerable machining. The reduction of machining operations severs one major bottleneck in many plants. Machine chips are the most costly things to produce, and the most useless. One great contribution to the Defence Programme which the casting industry can make is the time saved in the machining of castings as against

ArmaSteel—Its Manufacture, etc.

forgings. Up to 50 per cent. in man-hours per part is being saved in many Arma-Steel castings replacing forgings. This is possible by producing castings to closer tolerances than forgings, thereby machining less excess metal.

A considerable saving in tool life is effected in the machining of the castings due to less metal removed and an easier machinable metal.

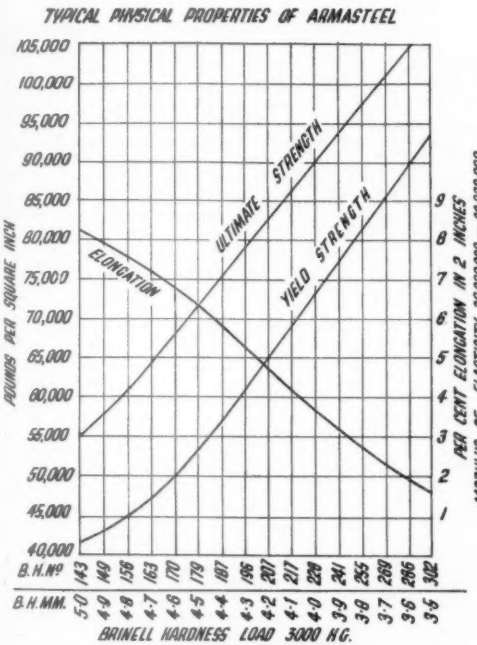


FIG. 36.—TYPICAL PHYSICAL PROPERTIES OF ARMASTEEL SHOWN GRAPHICALLY.

ArmaSteel castings show the following advantages:—

(1) Uniform structure for greater strength, shock and stress resistance.

(2) Metal distributed where it will do the most good, maximum strength, with minimum weight.

(3) Widest range of physical properties.

(4) Resistance to shock at sub-zero temperatures.

(5) Responds to localised hardening, with high hardenability rating and maximum wear resistance.

(6) Good machining qualities, mirror finish, low finishing costs, better streamlined appearance.

(7) High rigidity, maximum deflection, accurate alignment, close tolerances and better fits.

(8) High fatigue resistance, maximum endurance and longer life. Ideal for critically stressed parts.

In the original Paper, the author now includes an illustrated appendix showing the types and properties of the castings made in the new material.

TIN AND ITS USES

The current issue of "Tin and Its Uses" (No. 13), published by the Tin Research Institute, is devoted to emergency economies in tin. It is explained that, although in normal times the Institute's purpose is to develop new and improved uses for tin, this would be useless at the present time when a large proportion of the world's tin supplies is under enemy control. During the period of scarcity the Institute offers its services in the solution of tin economy problems. Accordingly, this issue describes practical methods of saving tin in various fields of use. For example, it is shown that important economies can be effected in joining lead-sheathed cables both by using a solder less rich in tin and by the use of a new type of joint requiring not more than one-third the quantity of solder needed for the traditional wiped joint. A saving of the order of 99 per cent. can be effected by using a cup and cone type of joint on lead pipes instead of the usual wiped joint. The ends of the pipes are shaped to male and female cones, which are then sweated together with solder foil. A standard lead pipe joined in this way with only 0.05 oz. of solder withstood a pressure of 1,130 p.s.i. An article on "Bearings with Less Tin" reviews the recommendations made by the Technical Advisory Committee of the Ministry of Supply. This issue also includes a discussion of the pros and cons of a wartime extension of de-tinning, and some notes on recent American experience in soldering cans made from thin electro-tinplate. "Tin and Its Uses" is obtainable, free of charge, from the Tin Research Institute, Fraser Road, Greenford, Middlesex.

PUBLICATION RECEIVED

Revised Reading List Covering Foundry Practice and Patternmaking. Issued by the Central Library, Sheffield, 1. Commendable attention is being given by the chief librarian of the Sheffield Central Library to the requirements of the foundry industry, and this publication is a second edition of one published in December, 1941. It brings the bibliography up to date and includes the books which have been published in the U.S.A. during this year. The City Librarian, Mr. J. P. Lamb, has kindly offered to send a copy to any of our readers in exchange for a 2½d. stamp to cover postage.

SCRAP SEGREGATION

By "Onlooker"

The establishment of fixed prices for copper, lead, spelter and tin, the three first since the beginning of the war and the last in December, 1941, when Japan struck the first blow and trading in tin was suspended on the Metal Exchange, has removed one source of anxiety from the minds of manufacturers, who may, however, sometimes wonder what kind of price problems will face them when the war is over. Whatever these may prove to be it is quite certain that others remain, and among them is the vexed question of scrap. As the war goes on and production rises still further, the quantity of process scrap to be dealt with increases in proportion, and it is essential if the best possible use is to be made of our raw material supplies that this secondary metal should be absorbed into production. As everyone connected with the trade knows, scrap varies very much in make up and quality, apart from the two main divisions of "process" and "collected," so that it is not difficult to realise what a variety of troubles can lie in store for the unwary buyer of secondary metal. In this country we have not adopted the somewhat voluminous list of descriptions which guides the scrap trade across the Atlantic, but there are certain well-known named types of old metal implying, and in practice guaranteeing, standards of form and purity recognised by all concerned. Over a long period of years this method has worked well and is perhaps better suited to our national temperament than the more rigid American way of regulating the old-metal market.

In metal circles in this country one sometimes overhears the expression, "a good parcel spoilt," applied to a consignment of scrap metal, and the explanation of the remark is that by a small admixture of foreign matter some excellent metal has been rendered useless for high-grade work. It may even be that without sorting, often enough a laborious and costly undertaking, the contaminated parcel is fit only for refining and could not be introduced into alloy work. Since the war this contamination question has come very much to the front and the authorities have been obliged to intervene from time to time in the national interest, for with our dependence on seaborne supplies of raw materials it is absolutely essential that scrap shall be utilised to the best possible advantage. It will be remembered that the Ministry of Aircraft Production sent out a special instruction to all manufacturers, and action along somewhat similar lines was taken by the Ministry of Supply through the Non-ferrous Control. Perhaps brass swarf is more liable to give trouble in this respect than any other form of scrap as the authorities discovered when they tackled the problem of accumulations of secondary material. In this particular product, of which very large quantities are being made available to-day, one must expect to find a fairly high percentage of moisture and perhaps some free iron, but it is the *mixing* of qualities that causes all the trouble. Unfortunately, it has been found that swarf from special alloys, such as manganese bronze, for example, was not kept separate, while another form of contamination of the straight brass mixtures, *e.g.*, B.S.S. 218 and B.S.S. 249, came in the waste from light alloy mixtures. The presence of aluminium is, of course, most serious and the net result was that not only was the brass swarf worth very much less but, instead of going back into the manufacture of fuse rod, it had to be used in a wasteful manner, *i.e.*, for refining, in which case the zinc was probably lost. Proper segregation of scrap is a vital part of the war effort.

LIGHT METALS IN GERMANY

The position of Germany regarding mineral raw material production and supply, resulting from an eight-year mobilisation of resources through purchase and aggression, as well as internal effort, has been reviewed by the U.S. Bureau of Mines. In some instances, such as bauxite, aluminium, and magnesium, recent production has been greater than the combined output of the United States, Great Britain, and Canada.

In 1933, the United States output of aluminium was more than double that of Germany, but in 1940 it is estimated that Germany produced 264,550 net tons, against 206,100 tons in the United States. Aluminium production in German-controlled countries—France, Italy and Norway—and also in Switzerland, in 1940 was 15 per cent. greater than the combined output of the United States, Canada, and Great Britain, and amounted to 47 per cent. of the world total.

A recent survey showed that the aluminium plants in German-controlled Europe would have a total capacity of 617,300 tons by the end of 1941, compared with about 639,325 tons in the United States, Canada and Great Britain. By the end of 1942 or early in 1943, the productive capacity of the United Nations should exceed 992,000 tons. No data are available on Germany's expansion programme.

Germany is amply supplied with bauxite, the raw material essential to aluminium manufacture. Extensive deposits in France, Italy, Yugoslavia, and Hungary are situated in a much more favourable position for transport to the aluminium reduction plants than those from which the plants in the United States and Canada get their supply, principally from Surinam and British Guiana.

Present output in Europe is 50 per cent. of the world's production, whereas the western hemisphere contributes only 38 per cent. Both regions have large reserves from which additional production can be obtained, although the western hemisphere is at a disadvantage because of the transportation problem.

No official production figures are published in Germany on magnesium output and estimates vary from 19,850 to 66,150 net tons per year, the most recent being 44,100 tons for the German-dominated areas. In 1940 the combined British-American production was only 13,225 tons. Large plants are under construction in the United States and by the end of 1941, production in the United States and Great Britain was expected to have greatly expanded. By the end of 1942 or early 1943, the United States alone will be producing magnesium at the rate of 198,400 tons a year.

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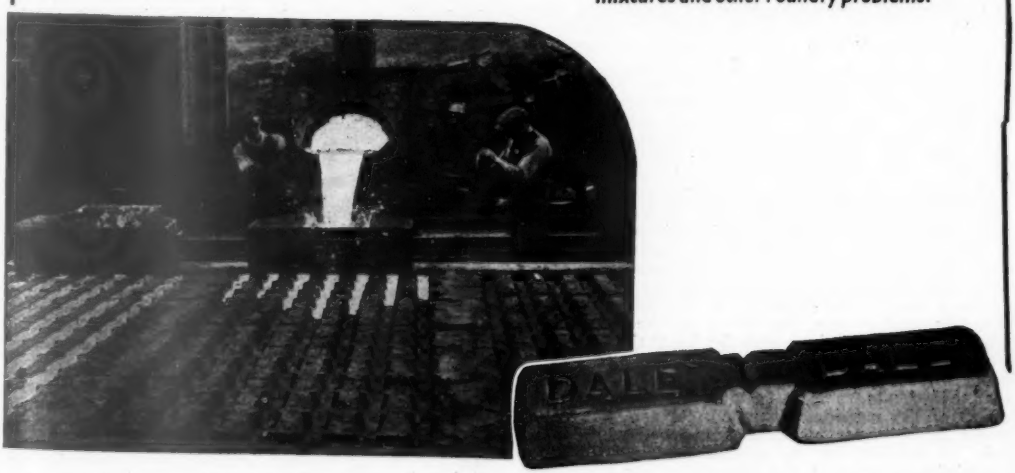
IS CHARACTERISED by closeness of grain structure, uniformity of composition and fine graphitic carbon evenly distributed.

IS PRODUCED to guaranteed analysis in seven standard grades.

CAN BE MADE to customers' individual requirements with total carbon from 2·6 per cent. upwards.

SHOULD BE USED to tone up high phosphorus irons and scrap, to replace Hematite, and to produce castings for all high duty purposes.

Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

CONCENTRATION OF IRON-FOUNDRIES

VIEWS OF MIDLAND REGION

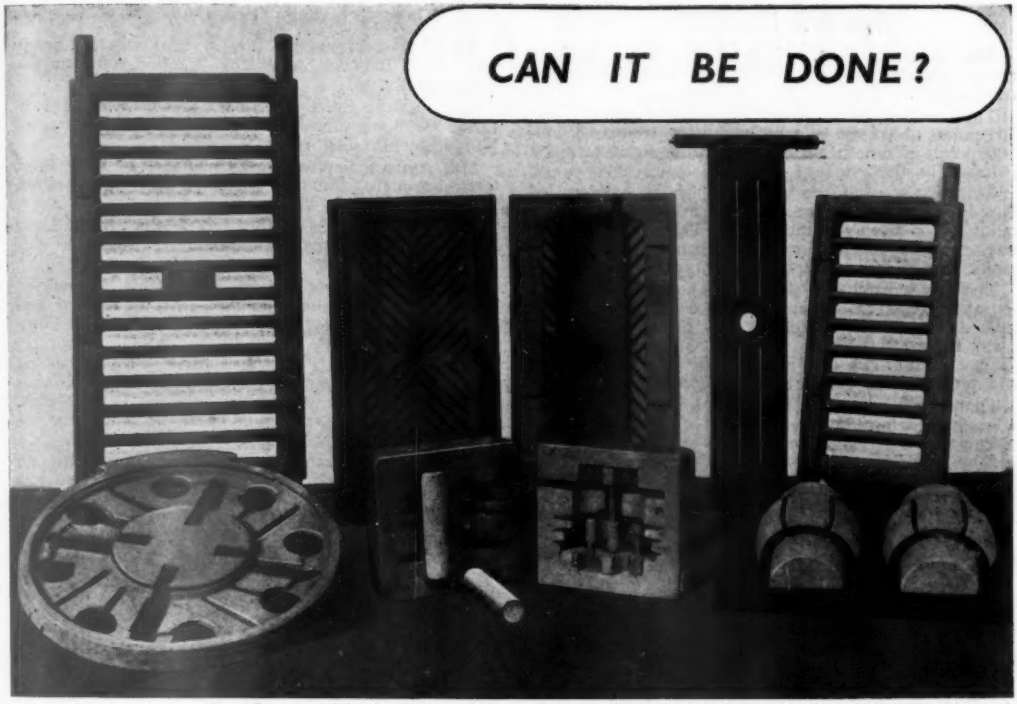
Organised through its local Concentration Committee by the Council of Ironfoundry Associations, a general meeting of representatives of ironfoundries in the Midland area affected by the Board of Trade concentration scheme was held at the Chamber of Commerce, Birmingham, on Tuesday, August 25. There was a very large attendance. The chair was taken by Mr. Fitzherbert Wright, chairman of the Council of Ironfoundry Associations, who had the support of Mr. A. E. Hurst and Mr. R. Forbes Baird, respectively chairman and secretary-elect of the Local Concentration Committee. These appointments were confirmed later by the meeting. After considerable discussion the meeting was adjourned pending consideration of the scheme by the various groups, who would then report to the Local Concentration Committee, the understanding being that no action would be taken in the meantime.

The chairman claimed for the Council of Ironfoundry Associations that it was a body representative of the whole industry. Practically every trade association and every technical association, with a single exception, he thought, was identified with it, so that it was in a position to speak for the industry. When the Board of Trade, at the end of last year, put forward the idea of concentration they asked for advice, and the advice given them at that time was that it was not thought there was much to be gained by such a scheme. "I am not sure that we were altogether right there," the chairman said, "because I think there probably is something to be got out of it." The chairman referred to difficulties that arose in the application of the concentration scheme to London, but said they had been overcome, and mentioned that future schemes would be agreed through the Council of Ironfoundry Associations. The Council formed a main Concentration Committee about two months ago and had elected, up and down the country, Local Concentration Committees which would deal with the various localities as they came under the axe. The Committee met in the previous week and went through the scheme. Subject to any obvious errors that it might contain, such as were found in the London scheme, they considered that it was a good attempt on the part of the Board of Trade, plus all the other Government departments, to do a very difficult job. All thoughts of personal inconvenience must be subordinated to the aim of winning the war, and it was the object of the Council of Ironfoundry Associations, with the Local Concentration Committee, to make matters as easy as possible for firms who had been told by the Board of Trade that their foundries must be closed down. The main object of the meeting was to correct any errors that might have been made, and to make the burden as light as possible for the people closing down. As regarded compensation, the Association was of opinion that district arrangements would not be altogether fair, and the suggestion was made to the Board of Trade that it would be more equitable to have a scheme which covered the whole country. The Board of Trade pointed out, however, that they had no powers to enforce such a scheme and that it would have to be a voluntary effort.

Mr. Hurst returned thanks for his appointment and having explained the constitution of the Committee said the concentration scheme dealt with both the cast iron trade and the malleable iron trade. Representatives present would already have heard from the Board of Trade whether their firms were nucleus firms or closed firms. Mr. Hurst referred to the suggestion made to the Board of Trade that any scheme of compensation should be national in scope, and said they heard with astonishment the Board's declaration that they had no powers to compel people to contribute to a national scheme, but that that must be a matter for the trade itself. It was perfectly obvious, Mr. Hurst said, that there were some firms which it was impossible for the Government to close, and if the Board of Trade had no power to compel them to contribute to a compensation scheme some of them might see fit to stand outside. Mr. Hurst also mentioned that it had been pointed out that if there was to be a national compensation scheme it should include the steelfoundries, seeing that they used the same labour and materials. As he understood the procedure, nucleus firms had to get into contact with closed firms and see whether they could take over their trade; alternatively, whether they could find accommodation in the foundry for the closed firm's workpeople and patterns so that they could make their own castings. A further alternative was that the nucleus firm should manufacture the goods ordered from the closed firm, charging a price to be agreed for the service, the closed firm to do all the invoicing. He gathered from notices sent out by the Board of Trade that firms were to reply by September 7 as to whether they accepted the scheme of concentration. He maintained that that was not possible. There should be an agreed reply that the scheme was having the serious attention of the Area Committee and that a reply would be sent as soon as possible. There were some closed firms who might be able to prove to the satisfaction of the Local Concentration Committee in the first place, and to the Board of Trade ultimately, that it was not in the national interest that they should be closed. He suggested to firms who thought they had a case that they should write to the Government departments for whom they were doing work asking them to communicate with the Board of Trade urging that it was undesirable that the firms in question should be closed and that they should be transferred to the list of nucleus firms.

In the course of the discussion, a number of propositions were submitted to the meeting, but failed to express the general feeling and were not voted upon. One was in the following terms: "That although hardships are bound to be experienced, a concentration scheme is practicable if a national compensation fund, paid for by the industry, is made legally effective on all foundries using the same raw materials, that is to

(*Continued on page* 20.)



Above Cores are exhibited by courtesy of Messrs. Cameron & Roberton Ltd. South Bank Iron Works, Kirkintilloch, Scotland

MUCH controversy has centred round the question of eliminating Core Irons in Oil Sand Cores. Can it be done? The above assortment constitutes an interesting range of light Cores, each of which has been turned out on a flat Plate and baked in the normal manner.

The point of interest in this assembly is the entire absence of Core Irons in any Core shown. In the entire assembly there are 7 loose pieces of steel rod acting as stiffeners. Some of the Cores are entirely without stiffeners of any kind. To ensure reliable results at all stages of operations, a good binder is necessary and for this purpose G. B. Kordek has been employed in all this work.

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CLEAN STRIPPING · ETC. ETC.

NEWS IN BRIEF

MR. ARTHUR FAIR, of Stenhousemuir, has been elected general secretary of the Ironfitters' Association of Scotland.

THE COST-OF-LIVING index figure at August 1 was 101 points above the level of July, 1914, compared with 100 points a month earlier, the rise being due to the increase in the price of coal.

BULLETIN-POSTERS are being sent by the Ministry of Supply to firms engaged in the non-ferrous metals industry for display in the works. They emphasise the importance of non-ferrous metals in the production of tanks, ammunition, aircraft and ships.

THE GOVERNMENT of Southern Rhodesia has agreed to pay £200,000 as the purchase price of the Rhodesian Iron & Steel Corporation's undertaking, now under State control, together with an amount equal to Excess Profits Tax and income tax on the Revenues and profit of the Corporation at August 1.

THREE MEN who tried to rescue a fellow-worker in a gas-laden atmosphere at the top of a furnace at the Normanby Ironworks, and who were also overcome and collapsed, were commended for their bravery by the Coroner at a Middlesbrough inquest. They were John Rowland Mocat, Cecil Johnson, and Edward Stockhill.

THE FIRST of a series of conferences to discuss problems affecting the building and civil engineering industries, with particular reference to the post-war period was held at the Institution of Civil Engineers in London last week, Prof. C. E. Inglis (President of the Institution) presiding. Lord Portal (Minister of Works and Planning) addressed the conference, being followed by Mr. W. H. A. Ansell (President of the Royal Institute of British Architects); Mr. R. Coppock (General Secretary, National Federation of Building Trade Operatives); Mr. T. Howarth (President of the National Federation of Building Trade Employers), and others. Further meetings have been arranged.

CONCENTRATION OF IRONFOUNDRIES

(*Concluded from page* 18.)

say that such a scheme must include all grey iron, malleable and steel foundries."

At the close of the meeting, Mr. Fitzherbert Wright drew the attention of the meeting to the serious effect of concentration on the industry. Other events of similar importance might happen and this should drive home to foundry owners how essential it was that the industry should be united. Mr. Wright urged all those present who had not already done so to join their appropriate association, thus ensuring, in addition to other advantages, that the Council of Ironfoundry Associations should have behind it the full weight of the industry.

Mr. Hurst informed the meeting that the National Malleable Ironfounders' Association would meet at an early date to consider the scheme. The malleable trade therefore was not in favour of any action being taken that day.

The meeting was then adjourned.

OBITUARY

MR. JAMES MORRISON BOYLE, who was for many years with Babcock & Wilcox, Limited, of Renfrew, died recently.

MR. ARTHUR BILTON, secretary and director of T. B. Bilton & Sons, Limited, engineers and founders, of North Shields, died recently.

MR. ARTHUR SPIVEY, works manager of Rose Bros. (Gainsborough), Limited, engineers and ironfounders, died recently at the age of 65.

MR. ARCHIBALD GRAY, formerly of the firm of Gray & Caldwell, Limited, brassfounders, Paisley, died recently. He was 85 years of age.

MR. DAVID M'DONALD, of Fry's Metal Foundries, Limited, Glasgow, died recently. Mr. M'Donald had been engaged in the metal and foundry trades in Glasgow for many years.

MR. J. L. SIDDALL, who died recently at Folkestone at the age of 62, was with the British Copper Manufacturers until they were taken over by I.C.I. Metals, Limited. He became joint managing director of I.C.I. Metals, retiring in 1936.

MR. JAMES S. CARSWELL died at Portobello on August 21, in his 80th year. Mr. Carswell, who was born in Derbyshire, trained as an analytical chemist. He later joined the engineering firm of Dickson & Mann, Limited, Armadale, and was appointed managing director.

PERSONAL

MR. W. T. BELL, chairman and managing director of Robey & Company, Limited, engineers ironfounders, etc., of Lincoln, celebrated his golden wedding on August 23.

CAPT. J. F. JONES, a director of Jones & Campbell, Limited, ironfounders, Larbert, Stirlingshire, has been awarded the Military Cross. Capt. Jones has been in command of an A.A. battery in Malta since December, 1941.

MR. WILLIAM TURNBULL, assistant works manager for Silley, Cox & Company, Limited, shipbuilders, engineers, etc., Falmouth, has been appointed general manager of the Blyth Dry Docks & Shipbuilding Company, Limited, in succession to Mr. Charles Wintersgill.

MR. J. M. WATSON has been appointed managing director of Ailsa Craig, Limited, London, makers of oil and petrol engines. Mr. Watson served his apprenticeship with the firm 34 years ago, and returns to it with a wide experience of the internal-combustion engine industry.

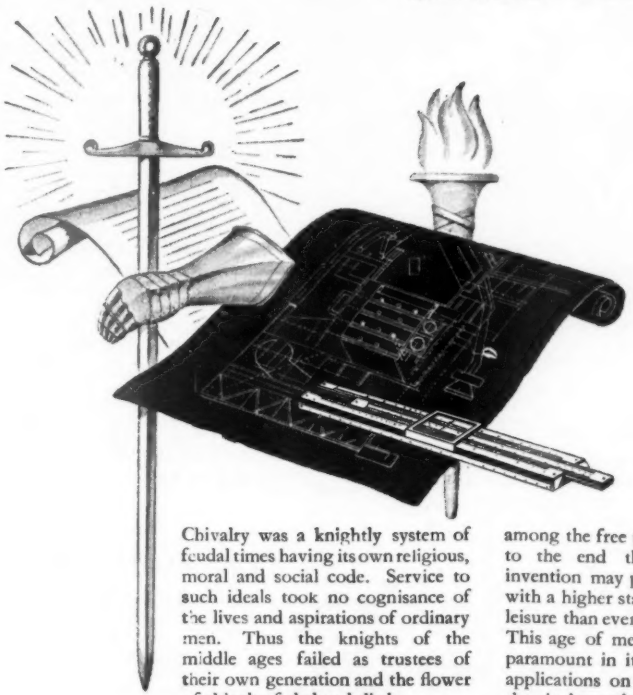
Wills

MURRAY, T. H., proprietor of Thomson & Stewart, ironfounders, Aberdeen	£13,570
WILSON, H. E., chairman of Evered & Company, Limited, brassfounders, Smethwick	£79,323
MARRINER, W. W., a director of Yarrow & Company, Limited, shipbuilders and engineers, of Glasgow	£32,414
WYNN-WILLIAMS, LLEWELYN, of Darlington, managing director of Llewelyn Wynn-Williams, Limited, railway engineers	£10,513

SEVEN PILLARS OF PROGRESS

5. "Men of science are among the trustees of each generation's inheritance of natural knowledge. They are bound, therefore, to foster and increase that heritage by faithful guardianship and service to high ideals."

'Charter of Science"—British Association, 1941.



Chivalry was a knightly system of feudal times having its own religious, moral and social code. Service to such ideals took no cognisance of the lives and aspirations of ordinary men. Thus the knights of the middle ages failed as trustees of their own generation and the flower of chivalry faded and died.

In its place their burgeoned a new heritage of service; that of the thinkers, the scientists, the engineers and technologists whose works display a deeper and more human appreciation of the common needs of mankind.

Service to these ideals is unremitting among the free peoples of the earth to the end that discovery and invention may provide each and all with a higher standard of living and leisure than ever before.

This age of metals, where steel is paramount in its many and varied applications on land, on sea and in the air, has only been made possible through the patient and never ceasing accumulation of knowledge concerning the properties of crude ores which have lain in the earth since the beginning of time. We will bear the torch which has been kindled with faith and dignity so that future generations may regard its light with pride.

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Samuel Fox & Co. Ltd., Sheffield | Workington Iron & Steel Co., Workington | United Coke & Chemicals Co. Ltd.
United Strip & Bar Mills, Sheffield | The Sheffield Coal Co. Ltd. | Thos. Butlin & Co., Wellingborough

Ⓜ U.S.P. 5.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Clayton Engineering Company—£3,000. J. R. Clayton, Dene Brae, Roehampton Lane, London, S.W.15; and J. B. Gledhill.

J. Bown & Company (Dukinfield), Dukinfield Ironworks, Dukinfield—Boiler makers. £6,000. E. E., H., and A. Bown, and H. J. Roberts.

J. & S. Brownlie & Company, 160A, Barkworth Road, Rotherhithe, London, S.E.16—Steel merchants, engineers, etc. £1,000. S. Brownlie and W. A. Renn.

John Heaton & Son (Leyland), 2, Towngate, Leyland, Lancs—Hardware manufacturers, sheet metal workers, etc. £10,000. W. Heaton, F. Holmes and T. W. Oliver.

Gauge & Tool Makers' Association (company limited by guarantee without share capital)—Subscribers, who will appoint the Council: R. Kuchner, 22, Hythe Road, London, N.W.10; G. Murray, Manchester; A. J. Mollant, Surbiton; H. H. Harley, Coventry; A. L. Dennison, Birmingham; H. S. Holden, Birmingham; T. Ratcliffe, Park Royal; G. P. Barron, Mitcham; E. F. Rudge, Birmingham; L. H. Wadsworth, Tooting; L. H. Barton, Leatherhead; F. W. Halliwell; A. Bell, Southampton; J. E. Baty, Victoria Street, London, S.W.1; C. R. Cook, Leatherhead, and H. J. Rowe, Peterborough.

SUBSTITUTE BUILDING MATERIALS

The Ministry of Works and Planning has issued to the building industry a further memorandum setting forth prohibitions in the use of various materials. The restrictions apply to all sections of the building trades. They aim at substituting hardwood for ferrous materials wherever possible, eliminating brass in favour of mild steel, and generally economising in the use of metal products. Steel and wrought-iron railings and gates, pressed steel stairs and partitions, wrought-iron balustrades and hand rails and galvanised roof ventilators are prohibited; the substitutes are concrete, brick or asbestos cement. Asbestos cement must be used instead of zinc, cast-iron and galvanised sheet iron gutters and rain-water pipes, although valley gutters may be of pressed steel. Galvanising is to be omitted from coal bunkers and metal windows, and instead of non-ferrous windows and folding or sliding windows the standard metal or concrete types must be used. Zinc and copper roofing is also prohibited.

SINCE JUNE 15, 1942, traders have been allowed to treat factory inspectors' and similar certificates issued for rubber boots before that date as the equivalent both of coupons and of a buying permit. These certificates, though retaining their coupon value, are now no longer valid as buying permits, and the supply of rubber boots will be allowed only on the surrender of the appropriate number of coupons and an official Board of Trade buying permit.

COMPANY NEWS

(Figures for previous year in brackets.)

Carrier Engineering—Dividend of 25% (same).

W. Canning & Company—Interim dividend of 5% (same).

C. Whittaker & Company—Dividend of 10% and a bonus of 7½% (same).

Ley's Foundries & Engineering—Dividend on the 5% cumulative preference stock for the half-year ending September 30 next.

Brightside Foundry & Engineering Company—Dividend of 1s. 3d. per share, or 25%, on the ordinary shares (15% and a bonus of 10%).

Monk Bridge Iron & Steel Company—Net profit for 1941, after providing £4,100 for depreciation and £2,182 for war damage contributions, £2,183 (£4,539); forward, £9,261 (£7,079).

Belfast Ropework Company—Net profit for the year to June 30, after providing for depreciation, income tax and E.P.T., £17,758 (£24,383); dividend on the preference shares, £2,500; ordinary dividend of 7% (same), £21,000; forward, £16,856 (£21,681).

Head, Wrightson & Company—Net profit for the year to April 30, £20,929 (£15,443), after fees, debenture interest, £126,000 (£130,000) for taxation, and £30,000 (same) for depreciation; final ordinary dividend of 3½%, making 6% (same); forward, £27,648 (£21,243).

S. P. Austin & Son—Trading profit for the year ended April 30, after providing for taxation and war damage contributions, £15,600 (£10,163); income from investments, £3,880; depreciation, £1,549; interest on debenture stock, £2,800; dividend on the preference shares, £3,500; dividend of 10% (7½%) on the ordinary shares, £6,500; written off goodwill, £3,536; forward, £1,368 (£324).

CONTRACTS OPEN

Hanley, September 7—Construction of cast-iron and asbestos-cement water main, for the Staffordshire Potteries Water Board. Mr. P. Wilkinson, engineer to the Board, Albion Street, Hanley. (Fee £5, returnable.)

Huddersfield, September 17—Construction of two intakes and the laying of approx. two miles of 24-in. cast-iron pipes, etc., for the Corporation. Mr. J. P. Beveridge, waterworks engineer, 24, Ramsden Street, Huddersfield.

WEST YORKSHIRE IRONFOUNDRY TRADE

"West Riding Ironfounders, Limited," has been formed with a capital of £500 in £1 shares "to promote and protect the interests of ironfounders in the West Riding of Yorkshire." The subscribers, who are to appoint the directors, are Messrs. G. Wilkinson, 232, Keighley Road, Bradford, and N. W. Green, 7, Leylands Avenue, Heaton, Bradford.

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- Conservation of Fuel.
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IN every siding, at every pit head and at all fuel depots, the contents of certain trucks and tanks are doomed to produce nothing except HEAT LOSSES. There are still many heat-generating plants of every kind which allow needless dissipation of heat. Normally, this is merely bad business—today the continuance of this WASTE opposes vital national interests. Waste could be stopped in many instances by the efficient use of insulation.

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G.P. 152

Raw Material Markets

IRON AND STEEL

Deliveries of pig-iron and scrap to the heavy engineering works are maintained at a substantial level. These works have large orders on hand for the various Government departments and are likely to remain actively engaged for a considerable time to come. Both medium- and low-phosphorus iron are rather difficult to obtain, while hematite is only sparingly released by the Control, as this material is in short supply and must be conserved for consumers engaged on important contracts and who cannot find an alternative grade of iron to meet their requirements. Engineers are able to procure all the high-phosphorus iron they need.

Orders in the light-foundry industry are now largely confined to castings required for Government buildings, Army hutments, etc., and there is only a limited demand for castings for civil building purposes, while the export trade, formerly a wide outlet, is dormant. Light-castings foundries are able to buy all the high-phosphorus iron they need, and many consumers have accumulated substantial reserve stocks, which will be more than useful during the winter months, when transport facilities may be less easy than they are at present.

Negotiations with regard to plans for the concentration of the foundry industry are understood to be well under way, and details are expected to be announced shortly. Light-castings foundries will be chiefly affected by this scheme, which is designed to conserve man-power and materials in the national interest, and many foundrymen are refraining from buying their normal supplies of iron pending developments in this direction.

Consumers of foundry coke continue to fill their storage accommodation where possible, but much of the trade in coke involves small quantities for early consumption. At the present time, the movement of fuel to points of consumption is satisfactory.

Busy conditions continue to rule in the steel trade. The plate mills are inundated with orders from the shipbuilding and other heavy industries, while the sheet mills also are briskly engaged. All forms of special qualities of steel are being absorbed freely, munition and armament works, etc., accounting for the full production.

Ironfoundries are in the market for quite large tonnages of cast-iron scrap of all kinds, but the main business in scrap metal continues to be with the steelworks, most of which are open to receive large consignments. On the whole, the delivery position is easier than it has been for some time past. While the short-term scrap situation is quite satisfactory in most respects, there is still need for precautions to be taken to cover future requirements, and it is imperative that steps be taken to improve and speed up the collection and grading of scrap metal.

NON-FERROUS METALS

An increase of 10 per cent. in the price of copper is announced in Chile. It is the result of an agreement reached between American and Chilean representatives. The agreement stipulates that the new price-list for the sale of Chilean minerals to the American Metal Reserve Company shall be reviewed every half-year.

The demand for zinc in the United States in 1941 set up an all-time record, due to the enormous requirements of the national defence programme and the lease-lend arrangements entered into with the Allies. Production from both domestic and foreign ores was also at a record level. These facts are divulged in information released by the U.S. Bureau of Mines. Production of slab zinc in the United States in 1941 at 881,523 short tons, exceeded the previous record of 1940 by 22 per cent. Production from domestic ores advanced 11 per cent. to the largest tonnage on record, while the quantity produced from foreign ores was 63 per cent. greater than the previous record of 104,005 tons in 1916. Output of special high-grade metal (99.99 per cent. zinc) was 4 per cent. above 1940 and regular high-grade gained 79 per cent., the two grades together accounting for 43 per cent. of the total produced in 1941 as compared with 41 per cent. in 1940. High-grade metal, of course, is used extensively in the manufacture of munitions, etc., and the advance in the output is particularly significant.

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49 Wellington Street, London, W.C.2.

WARTIME ADDRESS to which all communications should be sent :—
3, Amersham Road, HIGH WYCOMBE, Bucks.
'Grams : "Zacatecas, High Wycombe."
'Phone : HIGH WYCOMBE 1792 (3 lines).

PUBLISHED WEEKLY : 21s. per annum (Home and Overseas).

OFFICIAL ORGAN OF : The Council of Ironfoundry Associations ; The Institute of British Foundrymen ; The Institute of Vitreous Enamellers ; The Welsh Engineers' and Founders' Association ; The Foundry Trades' Equipment and Supplies Association.

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Participating Associations : British Bath Manufacturers' Association ; British Ironfounders' Association ; British Malleable Tube Fittings Association; Cast Iron Axlebox Association ; Cast Iron Chair Association; Cast Iron Heating, Boiler and Radiator Manufacturers' Association; Cast Iron Segment Association ; Greensand Pipe Founders Association of Scotland; Ironfounders' National Confederation ; National Association of Malleable Ironfounders ; National Ingot Mould Association ; National Ironfounding Employers' Association; Agricultural Engineers' Association (affiliated) ; British Cast Iron Research Association (affiliated); British Grit Association (affiliated); Institute of British Foundrymen (affiliated).

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21-23, St. Paul's Square, Birmingham. 'Phone : Colmore 4274-4275 ; 'Grams : *CIRA.*

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